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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/601,677	06/24/2003	Yoichi Hayashi	Q76243	7256

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EXAMINER	
VALENTIN, JUAN D	
ART UNIT	**PAPER NUMBER**
2877	

DATE MAILED: 07/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/601,677	HAYASHI, YOICHI	
	Examiner	Art Unit	
	Juan D. Valentin II	2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) *4-6* is/are withdrawn from consideration.

5)☒ Claim(s) *2 and 3* is/are allowed.

6)☒ Claim(s) *1* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 05/04/2006 have been fully considered but they are not persuasive. Claim one recites "a light projector that irradiates a parallel light made incident along the measuring points on the curved surface". Examiner maintains that Eigenstetter discloses this limitation as shown in the rejection below which has been maintained from the previous Office Action dated 02/06/2006. As shown in the abstract in conjunction with Fig. 1, Eigenstetter clearly shows the use of parallel light using the screen 6 in front of light source 5. Further, the curved measurement surface 1 is moving in the direction of arrow 4, and camera 8 is used to capture multiple images of the curved surface 1 along multiple measurement points as the curved surface 1 is rotated. Examiner has included a certified English translation of the Eigenstetter reference.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 rejected under 35 U.S.C. 102(b) as being anticipated by Eigenstetter et al. (DE 19514718 A1, hereinafter Eigenstetter).

Claim 1

Eigenstetter discloses an inspection device comprising a light projector 5 that irradiates a parallel light made incident along the measuring points on a curved surface, and a light receiver 8 that receives the parallel light that passes the measuring points and obtains the position of the measuring points based on the receiving position of the parallel lights. It is the position of the Office that the height variations 2 that the device of Eigenstetter detects are positional data that are attributed to the height differential from the ideal height and are determined by the light received by detector 8 (abstract, Fig. 1).

Allowable Subject Matter

3. Claims 2-3 are allowed over prior art of record.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 2, the prior art fails to disclose or make obvious "a second light projector that irradiates a third parallel light that passes a third measuring point set up on the outer diameter side of the inner surface of the flange, and a fourth parallel light that passes a fourth measuring point set up on the outer diameter side of the inner surface of the flange so that the third measuring point and the position in the circumferential direction of each flange may be the same position" and in combination with the other recited limitations of claim 2. Claim 3 is allowed by virtue of dependency on the allowed claim 2.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Juan D. Valentin II whose telephone number is (571) 272-2433. The examiner can normally be reached on Mon.-Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Juan D Valentin II
Examiner 2877
JDV
July 12, 2006

Gregory J. Toatley, Jr.
Supervisory Patent Examiner
13 July 06

1PTO 06-4684

German Patent
Document No. DE 195 14 718 A1

PROCESS FOR MEASURING CURVED SURFACES

[Verfahren zur Vermessung von gekruemmten Oberflaechen]

Herbert Eigenstetter et al

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. May 2006

Translated by: Schreiber Translations, Inc.

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Inventor	:	Herbert Eigenstetter and Franz Hepp
Applicant	:	Siemens AG, Munich, Federal Republic of Germany
IPC	:	G 01 C 7/00
Application Date	:	April 21, 1995
Publication Date	:	October 24, 1996
Foreign Language Title	:	Verfahren zur Vermessung von gekruemmten Oberflaechen
English Title	:	**PROCESS FOR MEASURING CURVED SURFACES**

/1[1]

PROCESS FOR MEASURING CURVED SURFACES

An early detection of deviations caused during the production should be possible in the production of LWL bands (1). With different LWL fiber distances are generated external irregularities on the surface profile (2) of the LWL band (1). These deviations in altitude from the ideal case, the straight line profile, can be determined by means of tangential illumination with simultaneous tangential image recording via a camera (8). The use of a reference cutting edge (10) arranged at a small distance over the LWL band (1) considerably increases the measuring accuracy. /2

Specification

The invention concerns a process for testing surfaces that are curved in one direction and are approximately planar to the curvature direction in vertical direction. Particularly the surfaces of optical waveguide (LWL) bands in which the surface is illuminated from outside are tested.

From the state of the art are known apparatuses and processes for continuously testing optical fibers, in which the light of a light source is coupled into the fiber, which has

[1] Numbers in the margin indicate pagination in the foreign text.

been produced in a drawing furnace. A detector is used to measure how much scattered light escapes to the outside following the drawing furnace in order to detect defects in the optical fibers.

In optical waveguide bands, several individual optical fibers are joined to form a wide band. Herein, a uniform side-by-side arrangement of these bands and aloft or in the center of the band is of decisive importance for the quality or for the light emitting efficiency. Consequently, the exact position of each individual optical waveguide fiber is of fundamental importance and a deviation thereof during the manufacture of the optical waveguide should be detected as rapidly as possible.

The practice provided until now for a destructive test, in which a random sampling is carried out. This is a very time intensive measuring method. In addition, the measurement cannot be automated, that is, it cannot be integrated into the production line. A defect within the optical waveguide band is detected in the visual determination used until now by cutting a LWL band and producing a grinding surface pattern of the cross section.

It is an object of the invention to measure a curved surface in such as way that small differences in height transversely to the curvature direction can be detected.

This object is attained by means of the features of claim 1 or claim 2. Advantageous embodiments can be inferred from the dependent claims.

In the invention, the curvature of the surface of an object to be tested, which is to be measured, is utilized in such a way that all the surface areas are continuously or successively approximately tangentially illuminated and the surface profile, which in the ideal case represents a straight line, is reproduced in a camera that is likewise arranged tangentially behind the object in the direction of illumination. In order to produce an image in the camera that is as rich in contrast as possible, the flat angle that is present under tangential illumination is selected so that the light arrives in the camera via an approximately complete total reflection on the surface of the LWL band. This reproduction is accordingly also possible with transparent materials, such as is the case with LWL bands, since an image that is rich in contrast can be obtained due to interference phenomena.

A further way of attaining the object of the invention is likewise carried out with approximately tangential illumination and approximately tangential image acquisition. In the area of the apex, which is illuminated, a so-called reference cutting edge is arranged at a small distance over the surface and

transversely to the direction of curvature. By means of the illumination from the side is generated a mirror image of the surface to be measured. With a simultaneous illumination of the reference cutting edge and the mirror image in the camera is reproduced a light gap in the ideal straight surface, wherein the upper edge corresponds to the reference cutting edge and the lower edge corresponds to the surface of the test object. The distance can be directly measured. An increase of the resolution by a factor of 2 can be attained by means of the reflection on the surface of the measuring object.

If the version of the invention without the use of the reference cutting edge is selected, it is advantageous to parallelize the light by means of a transversely placed slit diaphragm in the direction that is vertical to the surface. By using this slit diaphragm is increased the contrast in the image.

If an approximately tangential illumination and image acquisition cannot be carried out due to reasons of space, then the variant of the invention in which a reference cutting edge is used should be preferred. This is caused by the generation of a mirror image of the reference cutting edge, which is seen also with great irradiation angles. However, the simultaneous

reproduction of the reference cutting edge and the mirror image in the camera is required.

The use of a conventional camera requires an image evaluation or image processing process. Advantageously, a so-called CCD camera (semiconductor camera) is used. This has fundamental advantages for local resolution within an image.

Exemplary embodiments are described in the following based on schematic figures.

Figs. 1 and 2 show an automatic profile measurement on a LWL band with the corresponding monitor image.

Figs. 3 and 4 show an automatic profile measurement on a LWL band using a reference cutting edge and the corresponding monitor image.

Fig. 5 shows the approximate beam path on the side of the imaging beams in two random planes.

The production of the LWL bands provides that these run over a roller at a speed of, for example, 100 in/min. An optical image of the surface profile of the band that is curved is produced at this location on a CCD camera, with which two variations of the object of the invention are attained.

In Fig. 1 is shown a LWL band 1 with slight curvature. A measuring arrangement consisting of a light source 5, a slit diaphragm 6, an objective 7, and a camera 8 illuminates at a

specific apex the surface profile 2 existing at this location. The movement direction 4 of the LWL band 1 during production is indicated by means of the correspondingly noted arrow. A reproduction of the surface profile 2 can be produced in the camera 8 by means of the tangential illumination and likewise tangential image acquisition. The use of a slit diaphragm 6 is advantageous for increasing the contrast in the image.

In Fig. 2 is shown an example of a monitor image, that is, for the reproduction of the surface profile 2. The reproduced surface profile 9 has no vertical misalignments of any kind. From this, it can be deduced that the LWL fibers 3 are all positioned in the desired position.

In Fig. 3, the illumination and the image acquisition of an apex or a surface profile 2 are carried out using a reference cutting edge 10 likewise in approximately tangential direction.

/3

A slit diaphragm 6 is not provided herein. The reference cutting edge 10 positioned above the LWL band 3 at a small distance and parallel to this surface is as sharp as possible and configured as a straight line. Its image in the camera 8 can thus likewise be a straight line. On the one hand, the combination of the reference cutting edge 10 and the surface profile 2 at the point of the LWL band 3 located directly

underneath could be considered to be a slit diaphragm. Reproduced are, in this case, the reference cutting edge 10 and the mirror image 11 of the reference cutting edge 10 produced on the surface of the LWL band 1.

In a defect-free surface profile of the LWL band 3, as shown in Fig. 4, the image 15 of the reference cutting edge 10 appears as a contrast-rich line above the discernible light gap and the reproduced surface profile 9 of the LWL band 1 appears at its lower side. In this case, there are no fundamental defects in the shape of the vertical misalignments within the surface, in particular not at this apex.

In Fig. 5 is shown a view of a LWL band 1. The surface is not uniform, but shows vertical misalignments with respect to the surface profile 2. The representation of the illuminating beam 12 was omitted in Fig. 5 like in Fig. 1. It can be seen that the imaging beams 13, 14 for two selected planes cause, on the one hand, an image 15 of the reference cutting edge in the camera 8 and, on the other hand, an image 9 of the surface profile 2 in the camera 9. Due to the defective vertical misalignment within the surface profile 2 is produced the accordingly depicted mirror image 11 of the reference cutting edge 10, which is not a straight line on its upper side. At this location, it should be noted that a mentioned apex of the

LWL band 1 must not necessarily coincide with the surface profile 2, which is to be reproduced. In Fig. 5, the reference cutting edge 10 and the mirror image 11 do not lay one over the other.

The image in the camera corresponds with small curvatures of the LWL band 1 approximately to the band profile or the surface profile 2. Because of the mirror principle, it is enlarged by a factor of 2. Consequently, an increased resolution occurs when the reference cutting edge 10 is used. Optical distortions with the use of the simultaneously visible reference cutting edge 10 as reference straight line can be automatically compensated. The monitor image is suitable for the visual testing, as well as also for a fully automatic profile measurement in a production line using an image processing system. When using a highly accurate image processing system, it is possible to represent the profile characteristic for visual evaluation even more vertically misaligned that is possible by means of an optic with the direction visualization of the optical reproduction according to Fig. 5.

The measurement of a LWL band 1 is carried out as a rule on a slightly curved band that is guided along the static measuring device. It is also conceivable that an entire surface of a

curved body can be measured by establishing specific measuring windows, which are successively processed.

Patent Claims

1. A process for measuring surfaces, which have a uniform curvature in a direction and are approximately planar vertically to the curvature, by means of an optical image of a surface profile (2) in a camera (8), in which the illumination and the image acquisition in the curvature direction and relative to the surface profile (2) are carried out mutually opposite and in approximately tangential direction, so that deviations in the planar surface profile (2) can be detected.

2. A process for measuring surfaces, which have a uniform curvature in one direction and are approximately planar vertically to the curvature, by means of the simultaneous optical reproduction in a camera (8) of a reference cutting edge (10) and a mirror image (11) of the reference cutting edge (10) produced on the surface, in which the illumination and the image acquisition in the curvature direction and relative to the surface profile (2) are carried out mutually opposite and in approximately tangential direction, the reference cutting edge (10) is arranged over the surface profile (2) to be measured and

transversely to the illumination direction and in the vicinity of the approximately planar surface, so that a mirror image (11) of the reference cutting edge (10) is produced on the surface, and the reference cutting edge (10) and the mirror image (11) are reproduced in the camera (8) in order to detect deviations in the planar surface profile (2).

3. The process of claim 1, wherein a horizontally positioned slit diaphragm (6) is arranged behind the light source (5) in the illumination direction, so that approximately parallelized light is produced.

4. The process of claim 2, wherein the direction of illumination and image acquisition deviate relative to the curved surface in tangential direction, while the simultaneous optical reproduction of the reference cutting edge (10) and the corresponding mirror image (11) are retained in the camera (8).

5. The process of one of the preceding claims, wherein the camera (8) is a semiconductor camera.

6. The process of one of the preceding claims, wherein the surface of an optical waveguide (LWL) band (1) is measured.

7. The process of claim 6, wherein the LWL band moves in curvature direction.

8. The process of one of the preceding claims, in which the image evaluation is carried out automatically via an image processing system.

FIG 1

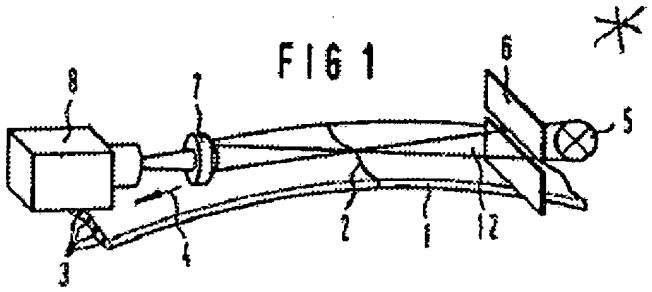

FIG 2

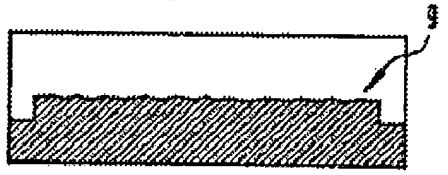

FIG 3

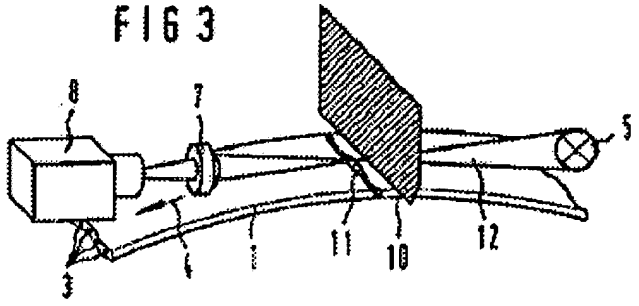

FIG 4

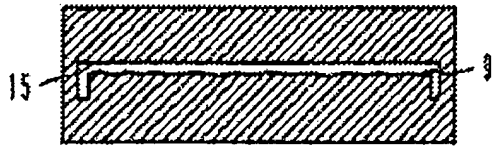

FIG 5